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HOUSE COMMITTEE ON
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TESTIMONY OF

MR. DYKE D. WEATHERINGTON

DEPUTY, UNMANNED AIRCRAFT SYSTEMS PLANNING TASK FORCE

OFFICE OF THE UNDER SECRETARY OF DEFENSE

(ACQUISITION, TECHNOLOGY AND LOGISTICS)

BEFORE THE UNITED STATES HOUSE

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

SUBCOMMITTEE ON AVIATION

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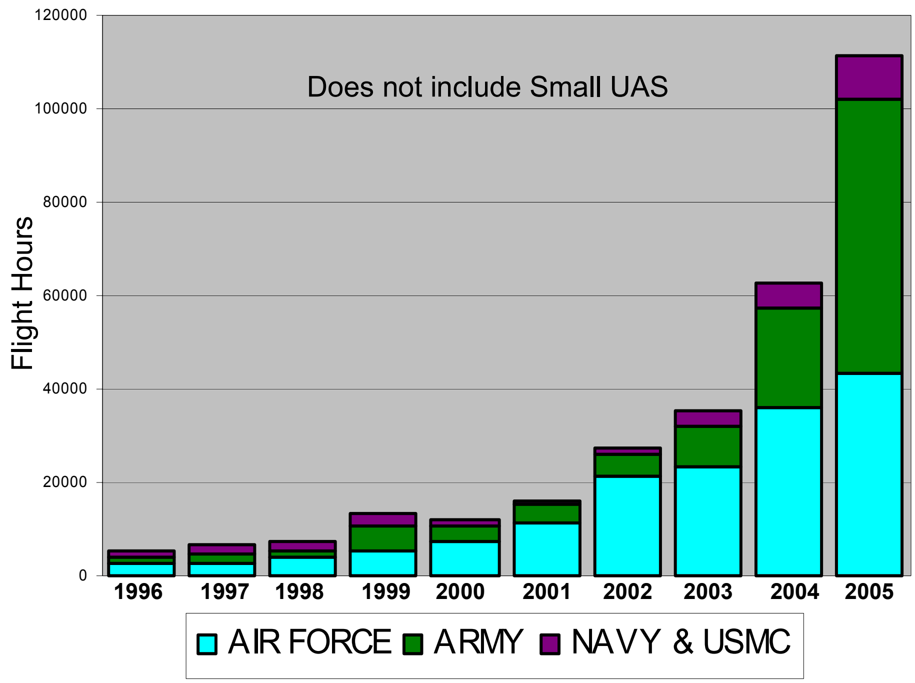
INTRODUCTION

Good afternoon Mr. Chairman, Mr. Costello, and Members of the Committee. I am the Deputy of the Unmanned Aircraft Systems Planning Task Force within the Office of the Under Secretary of Defense (Acquisition, Technology and Logistics) (USD(AT&L)). Oversight of unmanned aircraft systems (UAS) acquisition is one of my responsibilities, and that is why I am here today. I appreciate the opportunity to provide an overview of Department of Defense (DoD) UAS, and in particular our plan for the integration of these unmanned aircraft (UA) into the National Airspace System (NAS) and international airspace. The Department, using primarily ground-based radar to provide UA an equivalent level of safety as manned aircraft, has operated UA within the NAS without an incident resulting in death or injury since 1997.

DoD UAS are playing a major combat support role in both Operation IRAQI FREEDOM and Operation ENDURING FREEDOM. During the past year, UA operations supporting the Global War On Terror expanded dramatically, with tactical and theater UA flying over 100,000 hours. Figure 1 shows the UA flight hours flown by each Military Department. UAS are playing an ever increasing role in a wide range of DoD missions, including counter-insurgency operations, force and infrastructure protection, collection of vital intelligence, and strike of time-critical targets. UAS are also playing a vital role in homeland defense and domestic disaster relief operations, as well as supporting civilian agencies in other missions, including border security.

Figure 1.
DoD UAS Flight Hours (By Department, By Calendar Year)



Today, the Military Departments have a force of over 2600 small UA and over 300 tactical and theater-level UA supporting military operations worldwide. This is noteworthy when one recalls that the Department operated only one UAS type in support of Operation DESERT STORM in 1991; and as late as 2000, we had less than 50 operational tactical UA systems. Tables 1, 2, and 3 provide information on the major types and numbers of DoD UA existing today, with the UA grouped based on similar performance and airspace requirements. It is important to note that UA come in a wide variety of sizes and with differing capabilities and performance characteristics, this is particularly important with respect to the focus of this hearing on airspace integration. The Raven, as shown in Figure 2, is one of the “small UAS” listed in Table 1. Small UAS are operated by one or two soldiers, hand- or bungee-launched, and are used primarily for situational awareness and force protection in the local area out to a range of 5 - 6 nautical miles (nm), at altitudes up to 1000 feet, and for up to 1 hour. They are usually battery operated, carry electro-optical or infra red cameras, and are similar in size and performance to remote-controlled (RC) model aircraft.

Figure 2. Raven Small UA

TABLE 1. DoD Small UAS (Weight < 10 lbs., Airspeed < 100 kts), as of Feb 1, 2006		
System	**Service/Command**	**Total Aircraft Inventory**
Pointer	Special Operations Command / Air Force	126
Raven	Special Operations Command / Air Force / Army	1776
Dragon Eye	Special Operations Command / Marine Corps	402
Force Protection Airborne Surveillance System	Air Force	126
BATCAM	Air Force	54
Swift	Special Operations Command	212
	Total	**2696**

The Shadow shown in Figure 3 is an example of the tactical UAS listed in Table 2. Tactical UA typically operate at ranges of up to 80 nm, at altitudes up to 5000 feet, at airspeeds less than 120 knots, and for up to 5 hours; this group can be considered similar to manned ultra-lights in size and performance. They are typically operated from small airfields and carry electro-optical and infra red cameras, or other specified payloads.

Figure 3. Shadow Tactical UA

TABLE 2. DoD Tactical UAS, as of Feb 1, 2006 (Weight < 500 lbs., Airspeed < 120 kts)		
System	**Service/Command**	**Total Aircraft Inventory**
Pioneer	Navy / Marine Corps	34
Shadow 200	Army	140
Neptune	Special Operations Command	15
Tern	Special Operations Command	15
Mako	Special Operations Command	15
Tigershark	Special Operations Command	6
	Total	**225**

Theater-level UA are larger, for example the Predator A ((Figure 4) weighs 2400 pounds and Global Hawk (Figure 5) weighs 26,750 pounds. This class of UA generally operates beyond line of sight at altitudes ranging from 15,000 to 60,000 feet for up to 30 hours. The aircraft operate from established airfields, and if equipped with satellite communications can be

Figure 4. Predator A UA

"piloted" by operators located in another country. They typically carry electro-optical and infra red cameras, radars, signals intelligence payloads, or a combination thereof.

TABLE 3. DoD Theater-level UAS, as of Feb 1, 2006		
System	**Service/Command**	**Total Aircraft Inventory**
Hunter	Army	32
I-Gnat	Army	4
Predator A	Air Force	70
Predator B	Air Force	6
Global Hawk (Prototype)	Air Force	4
Global Hawk (Production)	Air Force	5
Global Hawk Maritime Demonstration	Navy	2
Fire Scout	Navy / Army	4
	Total	**127**

Figure 5. Global Hawk UA

OVERVIEW

Let me discuss the broad nature of UA systems, often referred to as "unmanned aerial vehicles (UAVs)." The term "UAV" puts emphasis on the air platform, ignoring the other essential components of an effective system – like the ground control station, the sensors and payloads, the communication links, and the data distribution infrastructure. We believe the term "unmanned aircraft systems" better captures the maturing nature of systems taken as a whole and have begun using this term, most notably in our update of the technology roadmap. This terminology encompasses the combination of components in the system, rather than focusing on a single element. It also properly identifies the airborne component as an *aircraft*, which is consistent with the Federal Aviation Administration's (FAA) view of these platforms.

In addition to the hardware components of UA systems, many other elements are essential to order our thinking, guide our engineering, and enable us to safely operate these systems. They include a systems architecture that allows data to be moved for a variety of uses, either a few miles or thousands of miles away. This architecture includes adequate spectrum and bandwidth for communication, airspace management and deconfliction, common data standards and formats to allow sharing and data fusion, deliberate contingency mission planning to deal with signal loss, common operating systems, and system interoperability. While most of these elements are not unique to unmanned systems, there are, in fact, distinct challenges in applying them to unmanned systems. Since cost is very important, all of these related elements, as well as the hardware components of the systems must be balanced with an eye on controlling system life-cycle costs, while maintaining a safe and effective system.

OVERSIGHT

In 2001, the USD(AT&L) formed the UAV Planning Task Force, now referred to as the UAS Planning Task Force, to provide oversight for all of the Department's major UAS acquisition programs and to provide guidance, as necessary, to maximize interoperability and commonality. Under my direction, the Task Force works with the Military Departments and Agencies to coordinate their acquisition planning, prioritization, and execution of UA system programs. During the past year, the Office of the Secretary of Defense (OSD) has been actively involved in molding the long-term Department vision for UAS with regular exchange of information with the Military Departments. We released a third edition in August 2005 of the *Unmanned Aircraft Systems Roadmap, 2005 – 2030* which provides guidance to ensure that Service-developed systems and capabilities support the Department's goals of fielding transformational capabilities, establishing joint standards, and controlling cost.

Of note, one of the top goals listed in the roadmap is to "foster the development of policies, standards, and procedures that enable safe, timely, routine access by UA to controlled and uncontrolled airspace." Appendix F of the roadmap is devoted to airspace integration and is based on our *Airspace Integration Plan for Unmanned Aviation*, released in November 2004. This was the first such Department-wide plan establishing top-level timelines to achieve the safe, routine use of the NAS by DoD UA.

AIRSPACE INTEGRATION PLAN

UA systems are increasingly being selected as materiel solutions to perform a wide variety of missions. The current capabilities support a broad range of user requirements, ranging from the bungee/hand-launched small UAS (such as Raven, Dragon Eye, and Pointer), through the tactical-level systems (such as Pioneer and Shadow), and up to the theater-level systems (such as Global Hawk). This expansive range of needs cannot be efficiently satisfied by a single UAS type. Rather, it results in tailored designs for specific operational capabilities and functions at each of the various levels, and also, differing airspace requirements.

Military UA have historically been flown for test and training in restricted airspace or operationally in war zones, and have thus largely been segregated from manned civilian aircraft. This is changing. The NAS is shared by all users, manned and unmanned, to support national defense, homeland security, and other civil and commercial operations. Unmanned aircraft must be integrated into the NAS while enabling safe, efficient, and effective operations. Since the September 11 terrorist attacks, airspace security has taken on increased priority, and the operation of DoD and Department of Homeland Security (DHS) UA in the NAS outside of restricted airspace is required for homeland defense, disaster relief support, and border security missions. During recent years, DoD UA have operated regularly along the Southwest Border in support of Border Patrol counter narcotic operations; and in 2005 the DHS operated DoD-contracted UA in support of the Arizona Border Control Initiative. In FY 2006 Congress, as requested by the President and proposed by the House and Senate, provided the DHS $10,180,000 for UA systems to be deployed between ports of entry on the Southwest Border for homeland security missions.

In order to integrate UA into the NAS, there are six key UAS-related regulatory and technology issues which must be addressed by DoD, to include: air traffic; airworthiness certification; aircrew qualification; see-and-avoid capability; command, control, and communications; and reliability. The *Airspace Integration Plan for Unmanned Aviation* details these issues and key drivers that must be addressed to achieve the goal of safe, routine use of the national airspace by DoD UA.

The general purpose of this plan is to outline the regulatory and technical infrastructure necessary for DoD to integrate military unmanned with manned flight operations in the NAS. Specific motivation for this goal can be seen by examining specific requirements of current military UA programs. These requirements include the capability for some UA to operate worldwide; and set significant new precedents for future UA operations in the NAS.

The Department's vision is to have "file-and-fly" access for appropriately equipped UA systems while maintaining an equivalent level of safety to that of an aircraft with a pilot onboard. For military operations, UA will operate with manned aircraft in and around airfields using concepts of operation that make on- or off-board distinctions transparent to air traffic control authorities and airspace regulators. The operations tempo at mixed airfields will not be diminished by the integration of unmanned aviation, and likely can be improved with procedures and technologies under development for UA. Positive aircraft control must be assured through secure communications and established procedures for UA operating in the NAS.

Certain guiding principles have been established in pursuit of this vision. These principles can be stated as follows:

- Do no harm – Avoid new initiatives, such as enacting regulations for the military user that would adversely impact the Military Departments' right to self-certify aircraft and aircrews, or air traffic control practices or procedures; or unnecessarily restrict civilian or commercial flights. Where feasible, provide a model to facilitate the adaptation of these regulations for civil use. This also applies to recognizing that "one size does NOT fit all" when it comes to establishing regulations for the wide range in size and performance of DoD UA.
- Conform rather than create – Integrate the existing Title 14 Code of Federal Regulations (CFR) (formerly known as Federal Aviation Regulations, or FARs) to incorporate unmanned aviation and avoid the creation of dedicated UA regulations as much as possible. The goal is to achieve integrated flight operations in the NAS.
- Establish the precedent – Although focused on domestic use, any regulations enacted will likely lead, or certainly have to conform to, similar regulations governing UA flight in International Civil Aviation Organization (ICAO) and foreign countries' airspace.

As mentioned earlier, the DoD and the FAA must address both technology and regulatory issues in order to reach the goal of "file-and fly." Within the Department, the DoD Policy Board on Federal Aviation provides policy and planning guidance for comprehensive airspace planning and coordinates directly with the FAA on DoD airspace related issues, while the Office of the USD(AT&L) provides oversight for technology development. I will now elaborate on specific key regulatory and technology issues related to integration of UA in the NAS.

DoD UA require safe, routine access to the NAS and international airspace for training and operations. In 1997 FAA and DoD agreed to allow DoD UA access the NAS using the Certificate of Authorization (COA) process. Current procedures, in accordance with FAA Order

7610.4, Chapter 12, Section 9, require an application for a COA to be filed with the FAA at least 60 days prior to operations for all UA operations outside of Restricted and Warning Areas, except procedures for non-joint DoD airfield operations will be as specified by DoD. COAs are typically issued for one-time events, are limited to specific routes or areas, and are valid for no longer than one year. In the case of Global Hawk a national COA was approved allowing NAS access with FAA coordination three working days in advance, but the COA must be re-approved annually. The FAA Order 7610.4 lists the circumstances that must be met in order to be granted a COA for operating in the NAS. Key requirements include a statement from the DoD proponent that the aircraft is airworthy and the proposed method to avoid other traffic, one that provides an equivalent level of safety, comparable to see-and-avoid requirements of manned aircraft. Methods to consider include, but are not limited to: radar observation, forward or side looking cameras, electronic detection systems, visual observation from one or more ground sites, monitoring by patrol or chase aircraft, or a combination thereof. Historically, DoD has relied primarily on ground-based radar for most UA operations within the NAS, and has done so without an incident resulting in death or injury since 1997. The COA process allows for DoD UA access to the NAS for events planned well in the future; however, it is insufficient to support unplanned operations. For example, DoD UA support for disaster relief in the wake of Hurricane Katrina was available, but not authorized. Instead small UA were attached to helicopter skids to provide some limited electronic collection capability. A significant number of DoD COA approvals have recently taken a full 60 days, or more, to be approved; and several critical DoD UAS programs are experiencing impacts from delays in COA approvals. Additionally, many UA industry members must rely on a DoD COA for access to the NAS. Over the last 20 years DoD was the only customer and the DoD COA provided adequate access to the NAS for industry; however, this is no longer the case. Industry also needs access to the NAS for independent development and demonstration of UAS to DoD and non-DoD customers.

While ground-based radar has been the primary means for providing the equivalent level of safety required for a COA approval; it has limitations and is not a long term solution. To mitigate radar limitations, DoD is developing “sense-and-avoid” technology organic to the UA that is at least as good as the human eye; i.e., an equivalent level of safety, comparable to see-and-avoid requirements of manned aircraft. Directly related to the technology development is the need for a standard to design and build to, and the need for data to measure the effectiveness of a given sense-and-avoid system. As a first step, the USAF Air Combat Command developed a functional-performance-requirements document to guide the design of a sense-and-avoid system. This document was, in turn, applied to the development of a civilian standards document: ASTM F 2411-04. As a next step, the Air Force Research Laboratory is now leading a UAS community team to turn the functional requirements into technical requirements for systems development. DoD plans to demonstrate optical systems in a sense-and-avoid role, applying available standards later this year. The FAA-endorsed RTCA Special Committee 203 is working to develop UAS-related standards, as well; however, the schedule does not support DoD requirements. With respect to measuring a sense-and-avoid system's effectiveness, modeling and simulation can be a valuable tool as it was in the initial determination of the effectiveness of the Traffic Alert and Collision Avoidance System for manned aircraft; however, the NAS airspace model needs to be updated and DoD UA sense-and-avoid models will need to be developed and validated.

Our *Airspace Integration Plan for Unmanned Aviation* discusses the regulatory and technology issues that need to be addressed to allow qualified UA to file-and-fly. It also recognizes that not all UA will likely be qualified to file-and-fly in all classes of airspace, and proposes three categories of UA:

- UA that comply with applicable sections of Title 14 CFR, Part 91, including the ability to see-and-avoid, would be qualified to file-and-fly. UA listed in Table 3 would be candidates for this category as technology matures.
- UA similar to light-sport aircraft and ultralights in size and performance and that can not fully comply with Title 14 CFR, Part 91, would still require a COA to operate in the NAS. Tactical UA listed in Table 2 would be candidates for this category.
- Small UA, those similar to RC model aircraft, would not require a COA if the operations met specific guidelines similar to those provided RC model aircraft operators. Small UA listed in Table 1 would be candidates for this category.

Standards and technology enabling UA to be qualified to file-and-fly are still being developed. Once the technology is developed and proven, regulatory changes will be required to allow UA to file-and-fly. Conversely, regulatory changes could allow small UAS to be operated more effectively outside of restricted areas in the NAS now.

In summary, DoD has safely accumulated hundreds of thousands of UA flight hours, many of which were in congested airspace in Iraq. DoD UA require routine access to the NAS outside of Restricted Areas for combat training, homeland defense and disaster relief operations; routine access that the current COA process does not accommodate. Changes to the current COA process can provide more routine, safe access to the NAS now while DoD and FAA work together to define and implement a long term plan for airspace integration for unmanned aviation. I believe that our *Airspace Integration Plan for Unmanned Aviation* is a good start to a long term plan. The Department's priorities for immediate action are:

1. Continue to work with FAA to approve all pending and future COA requests in a more efficient, expedited manner;
2. Work with FAA to provide greater flexibility for small UAS operations in the NAS; and
3. Work with FAA and other government agencies in the development of standards for sense-and-avoid capabilities.

CONCLUSION

The growth of UAS within the DoD has been dramatic and the DoD, as well as other organizations, have been challenged to adapt to this rapid growth. This technology provides the DoD, and likely other government agencies, with a powerful capability. All parties must work harder to maximize the effectiveness of UA operations in support of national security, and disaster support both at home and overseas without compromising safety. Today, most DoD and DHS UA operations in the NAS occur over very low population and airspace density environments, and our safety record clearly demonstrates that DoD UA do not pose a significant risk to the public, or are a hazard to safe airspace operations. Modeling and simulation of UA operations in the NAS could provide data to further substantiate the safety of current and planned UA operations, and the associated sense-and-avoid systems currently being developed.

Mr. Chairman, this concludes my prepared remarks. Again, thank you for the opportunity to express the Department's plan for integrating UAS into the NAS. I will entertain any questions you might have.